A Bibliometric Study of the Global Research Publication Activities in Rapeseed and Mustard

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ABSTRACT: *Provides yearly data for top 5 countries on Rapeseed – mustard research. The table 1 shows Canada is at the top in the list in area and production followed by China. Per ha yield of mustard in India is almost half of the Canada, Poland and UK. India has the lowest literautre production in studied areas the world.*

Keywords: Bibliometric Study, Growth Models, Activity Index, Relative Growth Rate and Doubling Time

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1. Introduction

Rapeseed-mustard are two important sources of oils and proteins. They are also used as medicine. Botanical names of rapeseed and mustard is Brassica. In the research, their term will be used as generic term for species of rapeseed and mustard, torai, etc. A thorough search has been made in CAB Direct with many related term. Rapeseed & mustard are widely cultivated in all continents. India is at third position with 6 million hac. but productivity wise it stands on lower position among the major rapeseed & mustard growing countries. Longer crop duration and high carbon contents in the soils are the major factors for high productivity in other countries. The status paper on rapeseed – mustard has provided data on area, production and yield of rapeseeds and mustard in various countries till 2016.[1]

S.N.	Country	Area(lakh ha)			Production(lakh tons)			Yield (kg/ha)		
(in years)		**2013-14**	**2014-15**	**2015-16**	**2013-14**	**2014-15**	**2015-16**	**2013-14**	**2014-15**	**2015-16**
1	Canada	80.09	80.75	83.2	179.55	155.55	183.8	2242	1926	2210
2	China	75.2	65.51	73	144.58	116	143	1923	1771	1950
3	EU	45.41	45.27	67.5	148.99	175.06	245.9	3216	3809	3640
4	India	66.5	57.9	57.62	78.8	63.1	68.22	1185	1079	1184
5	Australia	32.72	27.22	23.6	41.42	38.32	29.9	1266	1408	1270
6	Russia	11.09	10.62	10.6	13.93	14.64	13.2	1256	1378	1250
7	Ukraine	9.97	8.66	8.8	23.52	21.98	22	2360	2538	2500
12	Others	48.57	69.97	30.88	102.96	131.77	8.48	-	-	-
	World	369.55	**365.9**	**355.2**	**733.75**	**716.42**	**714.5**	**1986**	**1958**	**2010**

• EU= France + Germany + Poland + UK

Table 1. Area, production and yield of mustard & rapeseed of major countries (arranged by production 2015-16)

2. Methodology and Formulae

CAB Direct provides an electronic platform to access records on agriculture, environment, applied economics, food, nutrition and many other applied science subjects. It is leading resource.[2] The data for the present study has been collected from it available at Directorate of Soybean Research Centre, Indore (M. P.).

For the purpose of analysing publication data following statistical formulae have been used.

2.1 Relative Growth Rate

$$GR = \frac{Log_{e2}w - Log_{e\,1}w}{2^T - 1^T}$$

Here, $Log_{e1}w$ = log of initial number of articles.

$Log_{e2}w$ = log of final number of articles after a specific period of interval

2^T-1^T = The unit difference between the Initial time and the final time

2.2 Doubling Time

$$DT = \frac{Log_e 2}{GR}$$

Here, GR = Growth Rate, $Log_e 2 = 0.693$

2.3 Exponential Growth Model

$$F(t) = ae^{bt}$$

Here a = the initial size of literature;

t = time after which growth has to be calculated;

b = Continuous growth rate = $R/100$;

R = Percentage by which the size increases in each *fixed time unit.*

2.4 Linear Growth Model

$$F_o(t) = Log\ a + bt$$

Here, a = The initial size of literature;

t = time after which growth has to be calculated;

b = Continuous growth rate;

2.5 Logistic Growth Model

$$Ut = K / 1 + \mu$$

Here U = expected size of literature;

K and μ are two constants; t = time.

3. Literature Review

Many papers on bibliometric studies on agricultural sciences have been reviewed for this study. A few important one are given here. Anwar (2006)[3] has presented study on date palm and found increased growth rate (less than one before 1970 to 80 + during 1990s) & found Iraq and Egypt as leading contributors. Senthilkumaran (2007)[4] has made cross national comparison of spices research amongst the Asian countries over a period 1968–2002 using HORT–CD database. Research publication activity in science and technology by Gupta (2008)[5] compared and analysed the publication share, growth and strength of India and Germany in terms of world publications output and the share of international collaborative publications during 1996–2006. Kumar and Kumar (2008)[6] have reviewed research productivity of Indian Council of Agriculture Research Institutes in oil seeds. Sharma and Thomas (2008)[7] studied to examine the relative efficiency of the research & development process across a group of 22 developed and developing countries using Data Envelopment Analysis (DEA). Meena, Kumar and Jain (2014)[8] have used Activity Index, Publication patterns and RGR & DT in their study on pigeon pea for the during 2000-2008. Sagar, A., Kademani, B.S. and Bhanumurthy (2014)[9] have studied agriculture research in India during 1993-2012 based on Web of Science database. Tripathi, Sharma and Garg (2015)[10] have examined authorship pattern, prolific author, prolific institutions and identify subdivision of crop science. Most of contributions done by the agricultural universities and ICAR centres. Authorship had been calculated by dividing the total in four groups- single, two, multi-author (3 & 4) and mega author (more than 4). Tripathi and Garg (2016)[11] have been studied authorship pattern, subject wise, country wise study and institutional study. India tops in publication of articles. IARI is the highest productive institution in India.

4. Analysis

The study analyses research outputs of 76 countries during the period 2000 to 2013.

4.1 Geographical wise Distribution of Research Papers

Table 2 analyses geographical distribution of publications in the research. The study shows that India tops the list contributing 3588 (37.48%) articles, followed by USA with 1098 (11.47%), UK with 1004 (10.49%), Netherlands with 599 (6.26%) and Germany with 460 (4.80%) research papers. Other 71 countries contributed only 29.51% papers on this research.

The table 3 calculates values of mean, median and standard deviation of data on mustard research. The mean is 683.86, median is 681, and standard deviation is 96.65. For India, the Mean is 256.29, Median is 253.5 and Standard Deviation is 27.94 in the research. These results of mean and median reveals that both are a good representative of the data as the data is consistent.

Year	India	USA	UK	Netherlands	Germany	Others	Total	%
2000	233	56	44	14	24	133	504	5.26%
2001	220	59	30	26	27	165	527	5.50%
2002	297	71	47	40	22	196	673	7.03%
2003	296	62	55	28	37	150	628	6.56%
2004	265	72	47	41	27	200	652	6.81%
2005	314	74	60	51	27	186	712	7.44%
2006	249	77	77	43	23	201	670	7.00%
2007	258	70	76	67	34	210	715	7.47%
2008	259	99	70	51	29	181	689	7.20%
2009	241	63	71	65	34	196	670	7.00%
2010	229	68	85	34	42	233	691	7.22%
2011	223	123	95	44	40	250	775	8.09%
2012	263	115	122	47	49	286	882	9.21%
2013	241	89	125	48	45	238	786	8.21%
Total	**3588**	**1098**	**1004**	**599**	**460**	**2825**	**9574**	**100.00%**
%	**37.48%**	**11.47%**	**10.49%**	**6.26%**	**4.80%**	**29.51%**	**100.00%**	

Table 2. Geographical distribution of publications

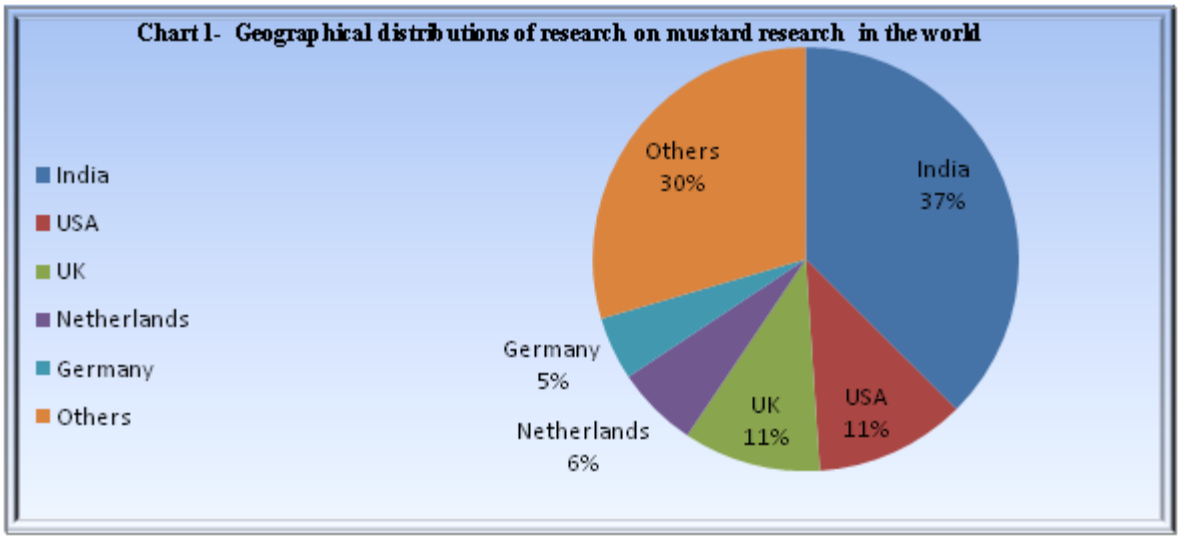


Table 3 shown that deviations of number of publications of India and USA are similar but it is less in USA. But the percentages of growth are higher in USA and UK (54 to 123 and 30 to 125 respectively). Here for India it is too less (220 to 314).

4.2 Communication Channels

Table 4 shows distribution of articles in different communication channels. Journals are the most preferred communication

	India	USA	UK	Netherlands	Germany	Others	Total
Median	253.5	71.5	70.5	43.5	31.5	198	681
Mean	256.29	78.43	71.71	42.79	32.86	201.79	683.86
S.D.	28.99	20.65	28.12	14.35	8.65	40.47	96.65

Table 3. Statistical analysis of publications on mustard research in the world

channel with 9115(95.25%) publications. It has been followed by conference papers 286 (2.99%), books 107 (1.12%), bulletin 29 (0.30%) and miscellaneous 37 (0.39%).

S.N.	Year	Journal articles	Conference papers	Book, book chapters	Bulletins	Miscellaneous	Total
1	**2000**	475	18	4	1	6	504
2	**2001**	495	16	8	5	3	527
3	**2002**	632	23	10	3	5	673
4	**2003**	587	26	10	2	3	628
5	**2004**	616	12	13	5	6	652
6	**2005**	667	31	12	1	1	712
7	**2006**	645	17	3	3	2	670
8	**2007**	683	14	14	3	1	715
9	**2008**	655	21	8	3	2	689
10	**2009**	649	19	0	0	2	670
11	**2010**	650	34	6	0	1	691
12	**2011**	745	15	11	0	4	775
13	**2012**	853	22	4	2	1	882
14	**2013**	763	18	4	1	0	786
	Total	**9115**	**286**	**107**	**29**	**37**	**9574**
	%	**95.21%**	**2.99%**	**1.12%**	**0.30%**	**0.39%**	**100.00%**

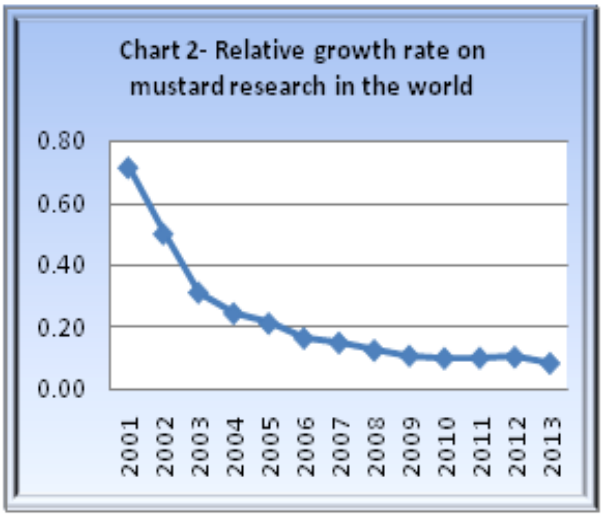
Table 4. Communication channels of publications on mustard research in the world

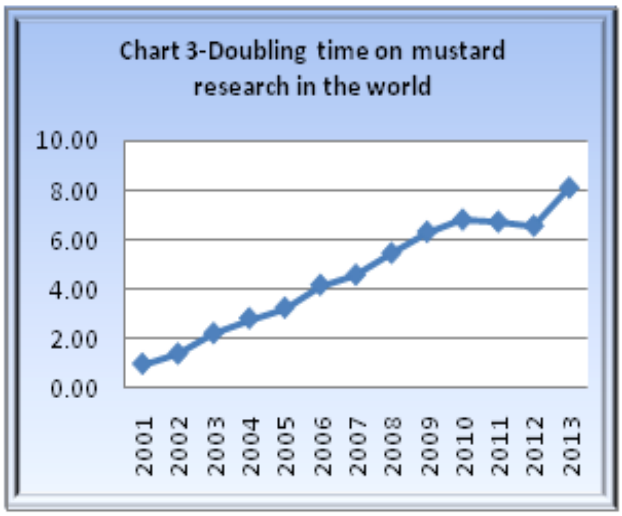
4.3 Relative Growth Rate and Doubling Time

Table 5 shows relative growth rate has continuously decreased from 0.72 to 0.09. Correspondingly doubling time has increased from 0.97 to 8.09.

S. N.	Year	Data	Cumulative Total	W1	W2	RGR	DT
1	2000	504	504		6.22		
2	2001	527	1031	6.22	6.94	0.72	0.97
3	2002	673	1704	6.94	7.44	0.50	1.38
4	2003	628	2332	7.44	7.75	0.31	2.21
5	2004	652	2984	7.75	8.00	0.25	2.81
6	2005	712	3696	8.00	8.22	0.21	3.24
7	2006	670	4366	8.22	8.38	0.17	4.16
8	2007	715	5081	8.38	8.53	0.15	4.57
9	2008	689	5770	8.53	8.66	0.13	5.45
10	2009	670	6440	8.66	8.77	0.11	6.31
11	2010	691	7131	8.77	8.87	0.10	6.80
12	2011	775	7906	8.87	8.98	0.10	6.72
13	2012	882	8788	8.98	9.08	0.11	6.55
14	2013	786	9574	9.08	9.17	0.09	8.09

Table 5. Relative growth rate and doubling time on mustard research in the world





4.4 Growth Models

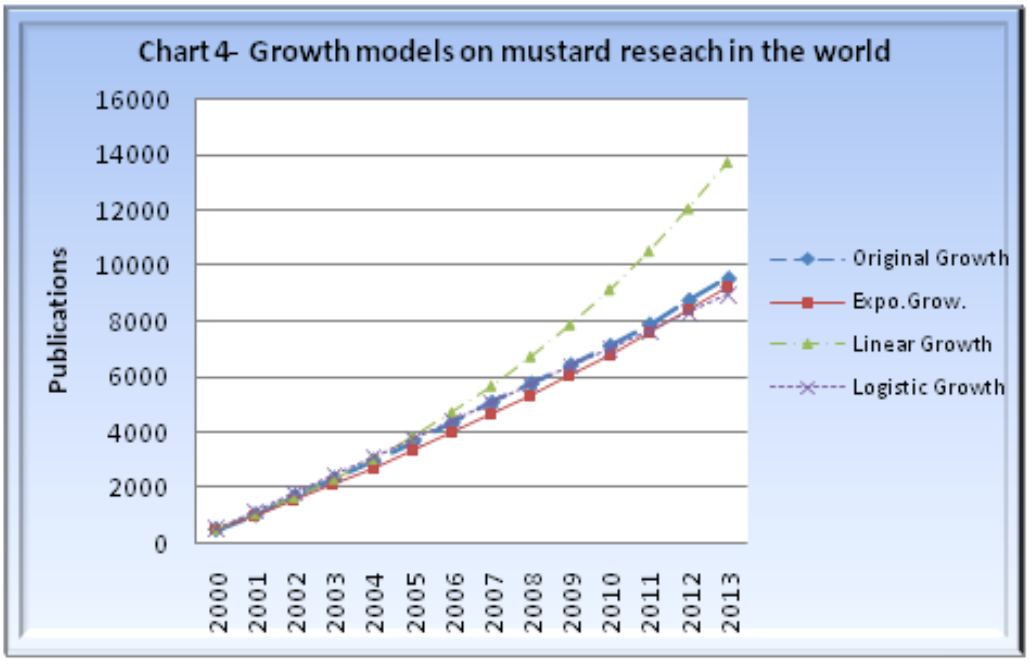
Table 6 calculates linear, logistic and exponential growth models. Cumulative values of exponential growth model and logistic model are nearly equivalent to the original growth. So, both models can be used to predict the growth of publications in mustard in the world. On the other hand, cumulative values of linear growth model are very far from original growth, so it is not suitable to predict future growth of mustard research productivity of India.

5. Conclusion

With the above study, it can be concluded that research activities on rapeseed-mustard research in India is very-very high as

S.N.	Year	Original growth	Exponential growth	Logistic growth	Linear growth
1	2000	504	504	505	504
2	2001	1031	1029	1149	1057
3	2002	1704	1575	1803	1663
4	2003	2332	2143	2457	2327
5	2004	2984	2734	3110	3055
6	2005	3696	3350	3764	3854
7	2006	4366	3991	4418	4730
8	2007	5081	4657	5072	5690
9	2008	5770	5351	5726	6743
10	2009	6440	6074	6379	7898
11	2010	7131	6826	7033	9164
12	2011	7906	7608	7687	10552
13	2012	8788	8423	8341	12074
14	2013	9574	9271	8994	13743

Table 6. Growth models (cumulative figures)



compared to other countries in the world. Though we are lowest among 7 countries in production and yield. It is a fact that India is still importing edible oils in very large quantity and spending huge foreign exchanges. More research is necessary to increase yield and production and decrease dependency on imports, as has been done in wheat production from an importer to an exporter.

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